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(54) Abstract Title

Motor vehicle door lock with anti-theft system

(57) The invention relates to a motor vehicle door lock which comprises a theft protection system. A central locking lever (8), an exterior locking lever (7) and a coupling lever (13) are swivel-mounted on one bearing axis (15). A theft protection power take-off element (17) and a theft protection disc (18) are rotatably mounted on an axis of rotation (16) which is parallel thereto. The theft protection disc (18) cooperates with the coupling lever (13) when driven by the theft protection power take-off element (17). A central locking drive (9) acts on the central locking lever (8) and a theft protection drive (25) is provided which acts on the theft protection power take-off element (17). In detail, when the theft protection system is activated the interior locking lever executes an inoperative stroke since the coupling lever (13) is locked by the action of disc (18). This coupling lever (13) forms the connecting element between a rotary latch (1) with a pawl (2) and the locking mechanism or the theft protection locking system. The position of lever (13) enables or disables the action of a pawl release element (3).

Fig.1

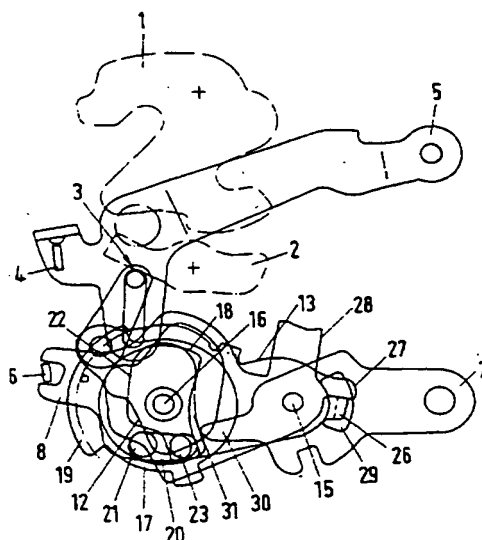
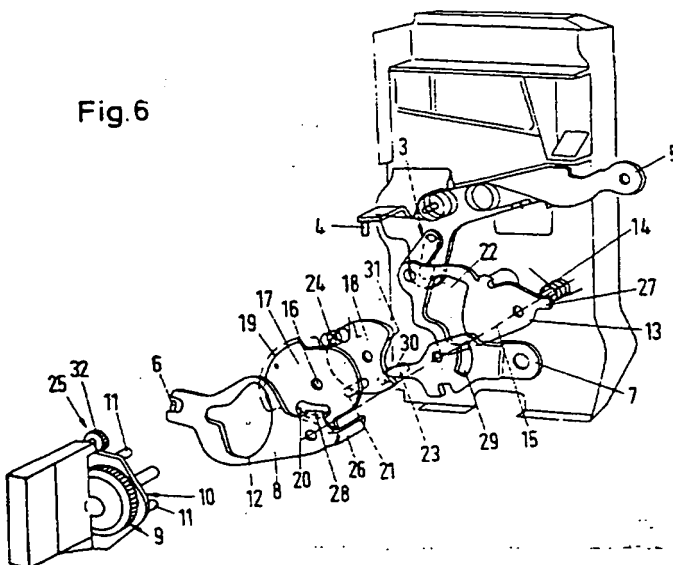


Fig.6



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Fig.1

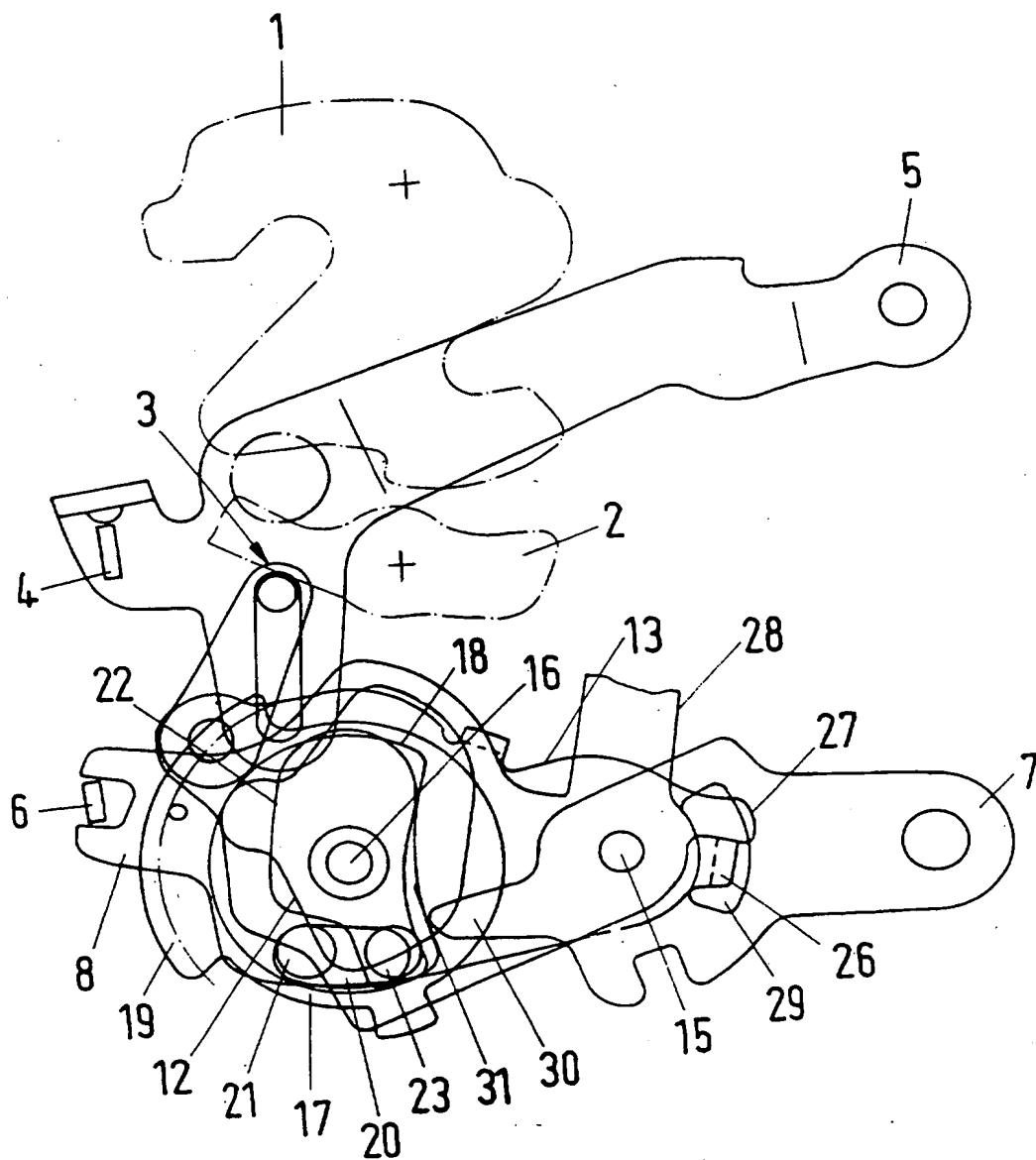


Fig. 2

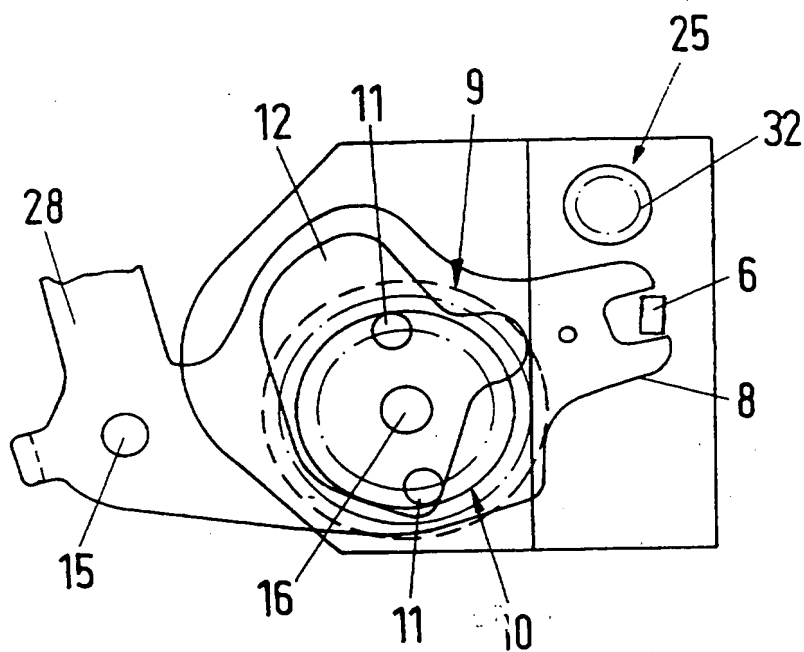


Fig.3

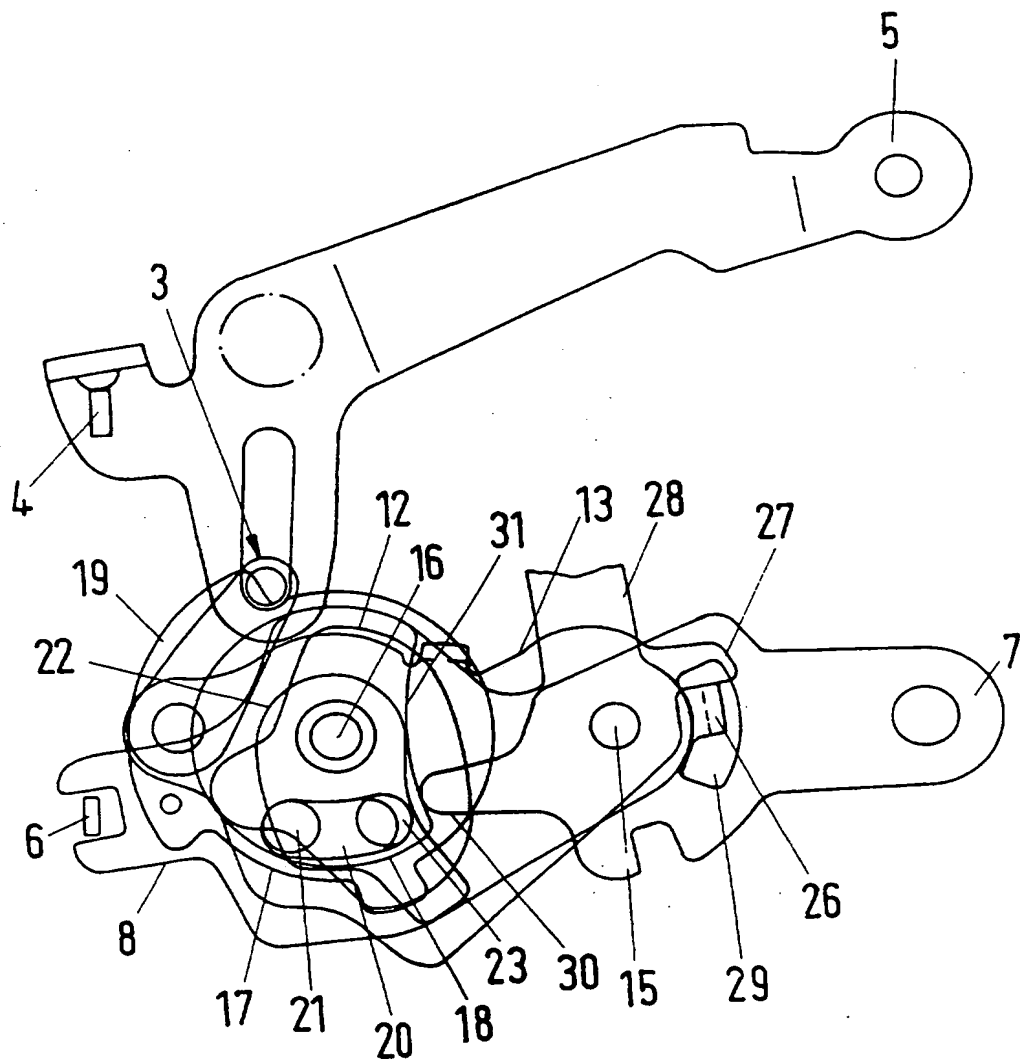


Fig. 4

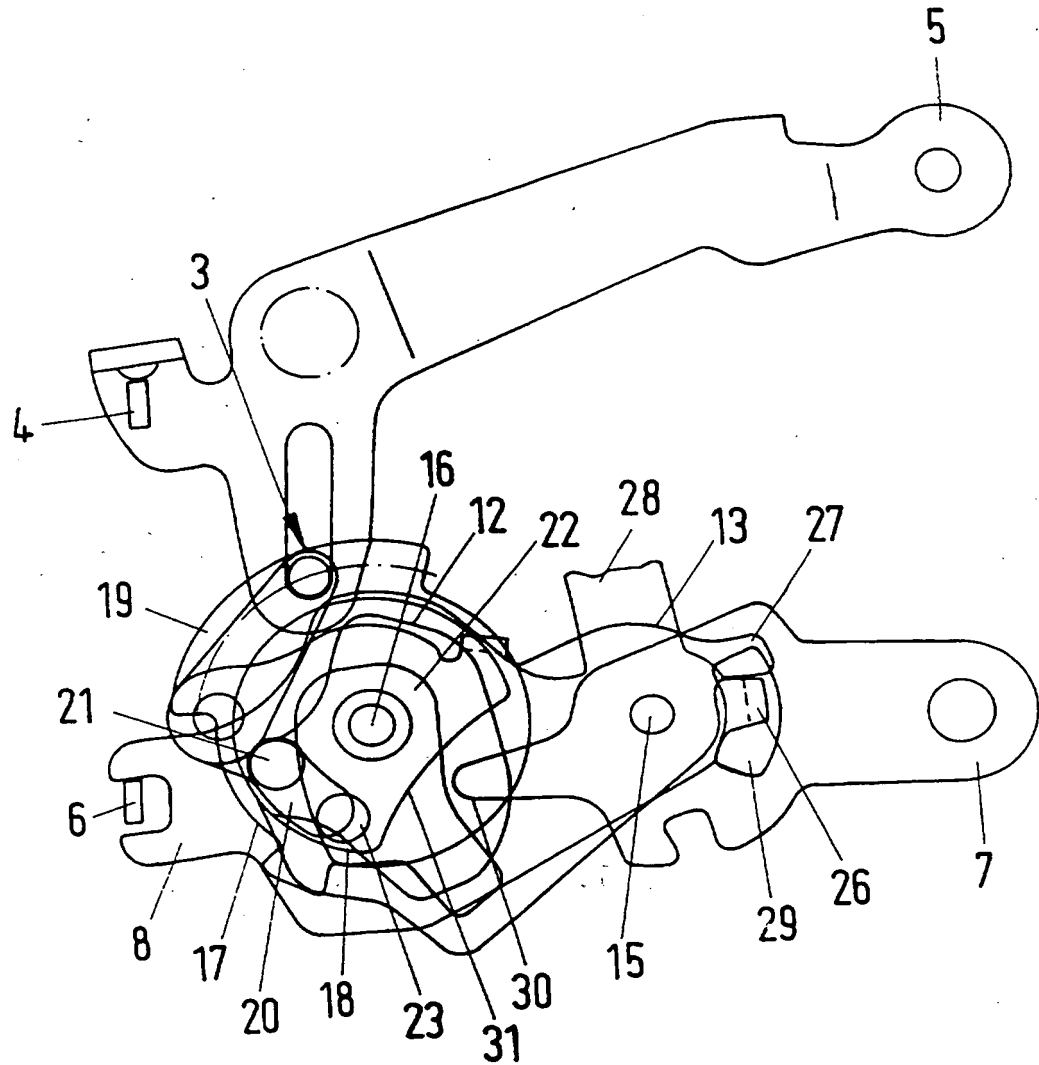
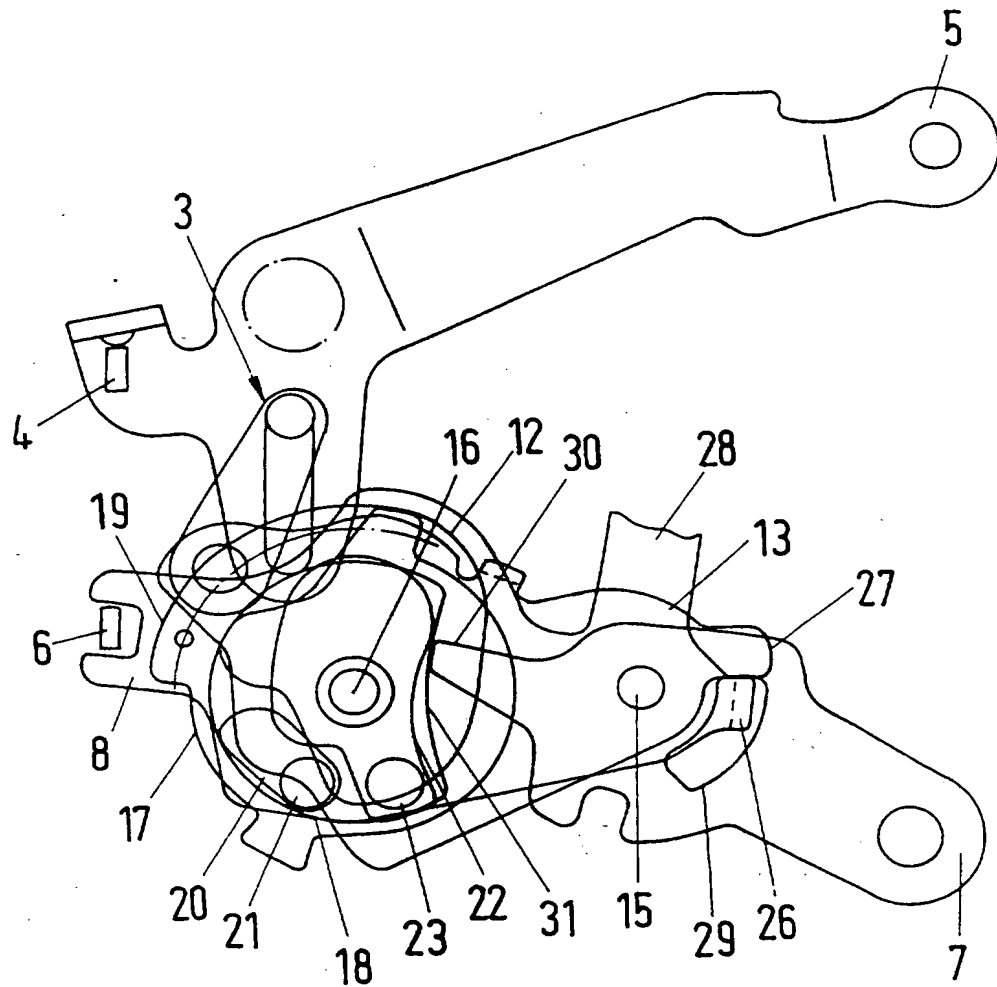


Fig. 5



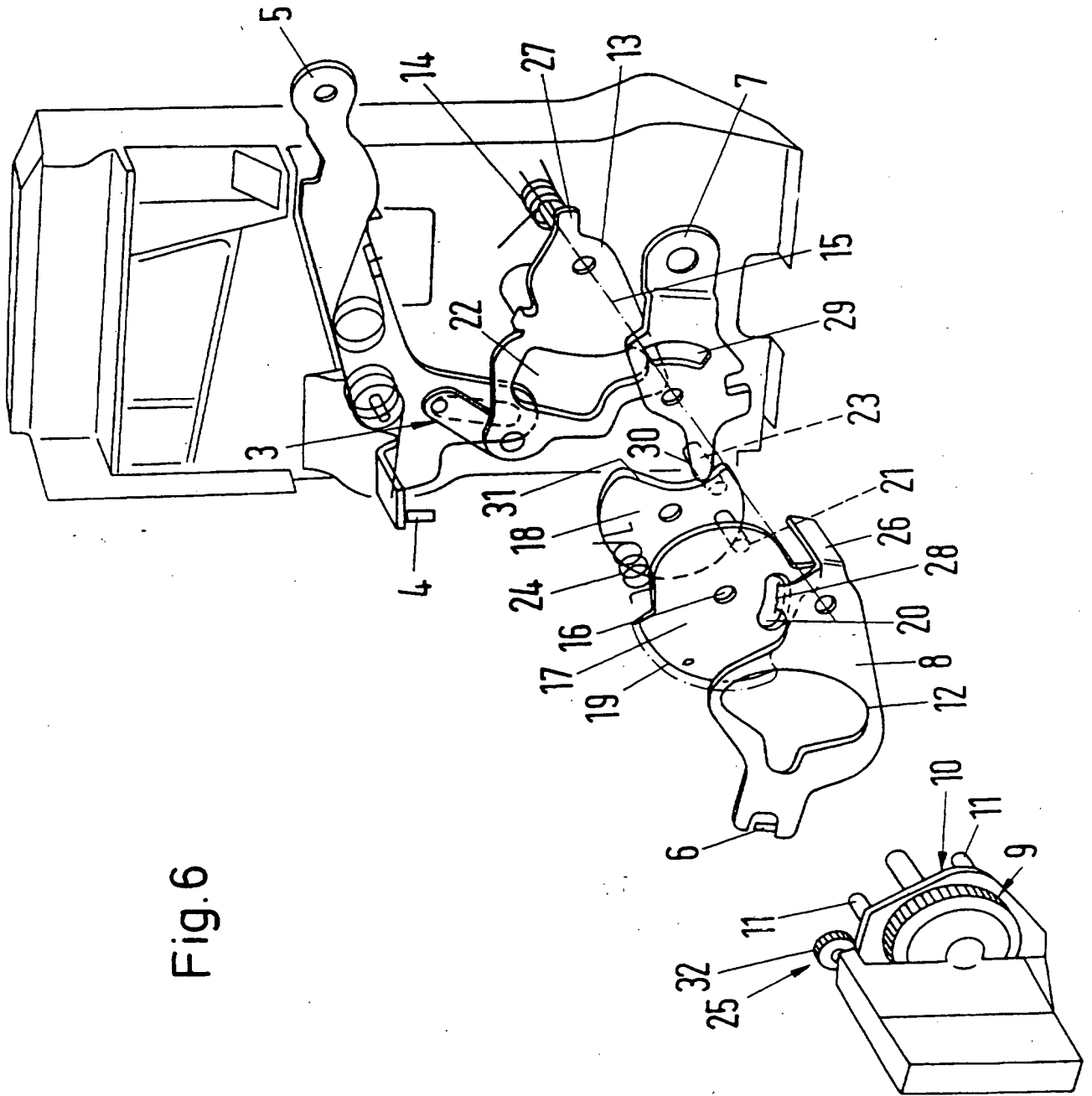


Fig. 6

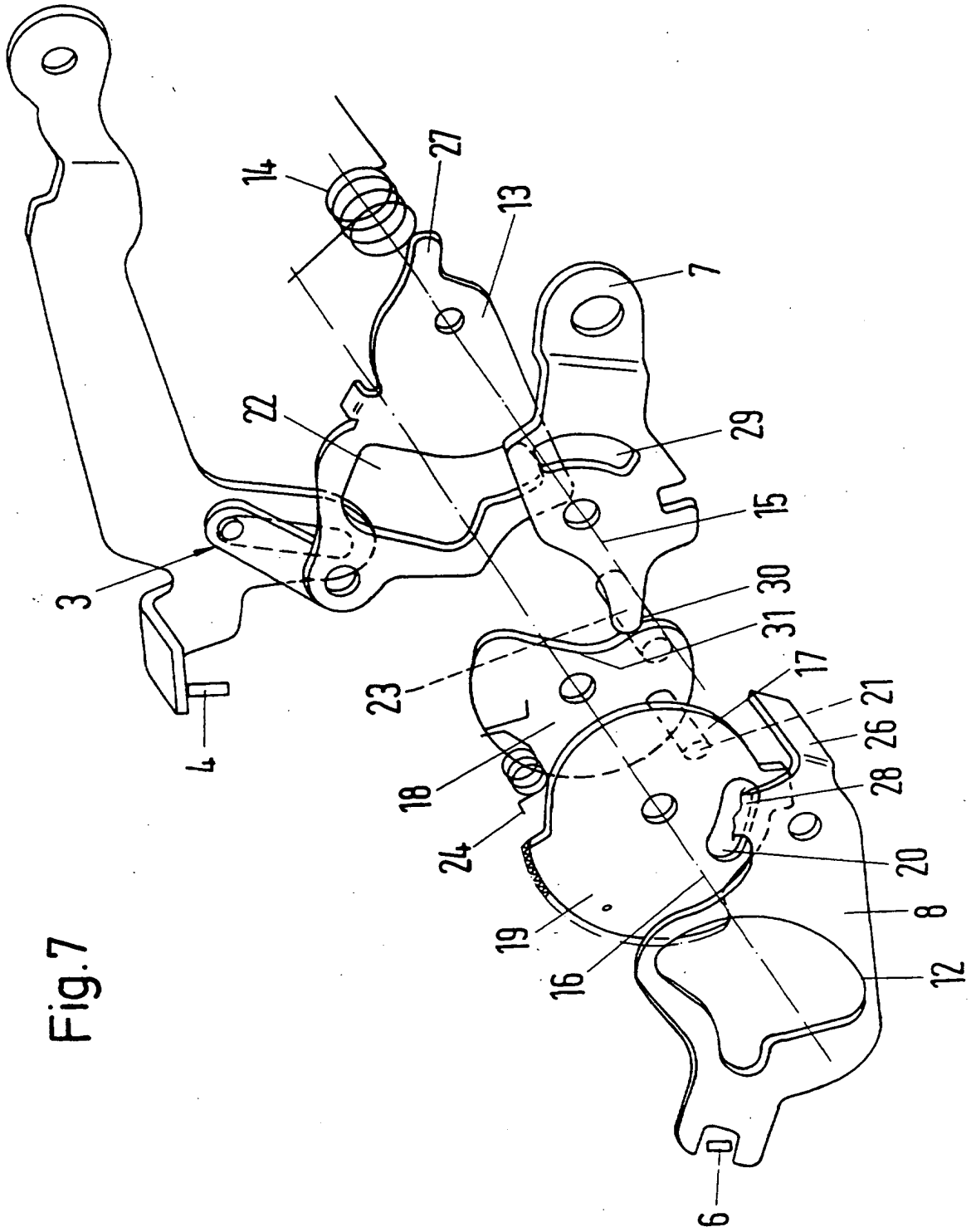


Fig. 7

Fig. 8

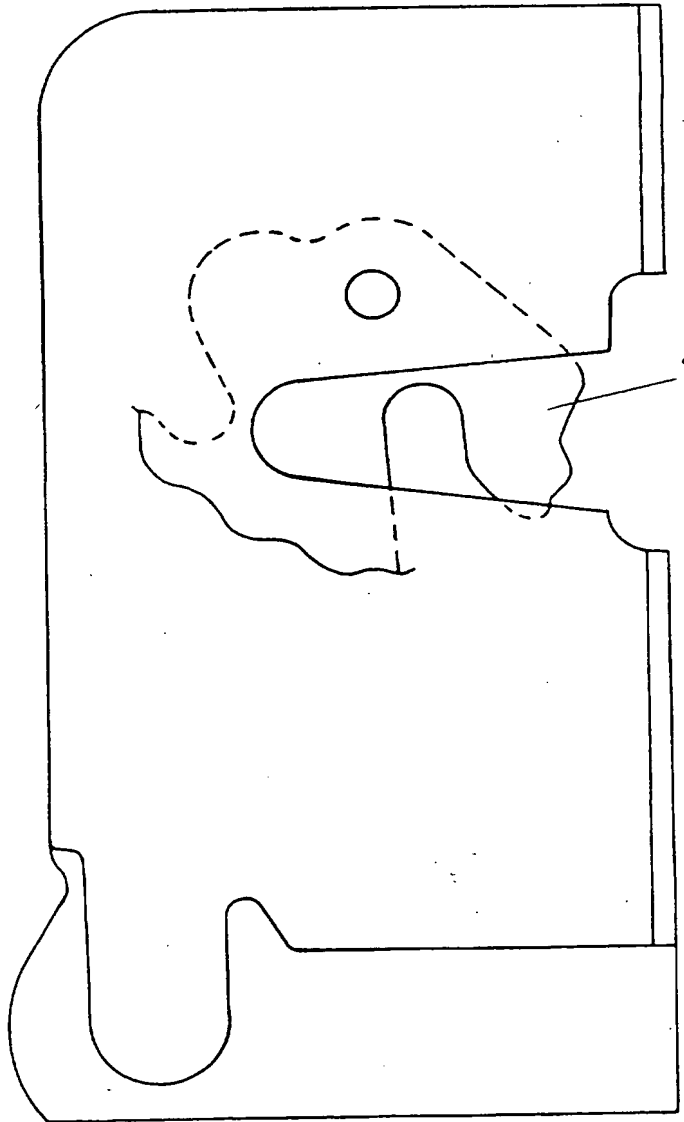


Fig. 9

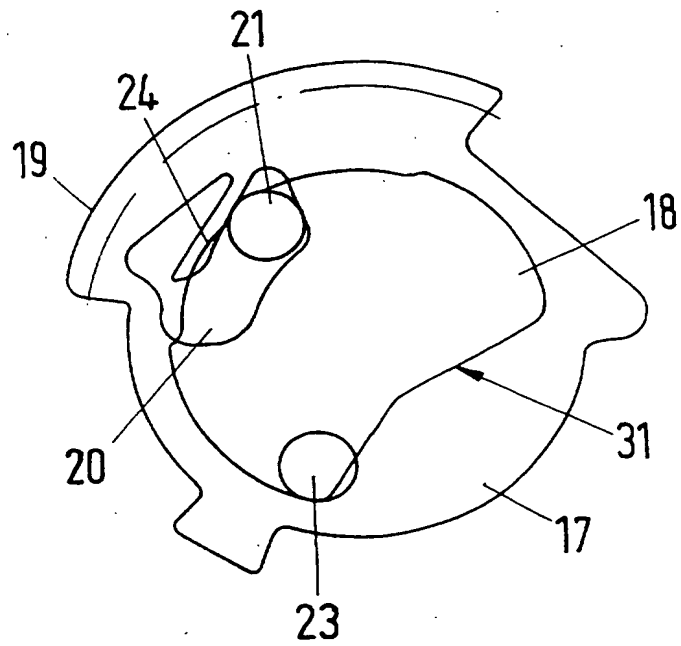
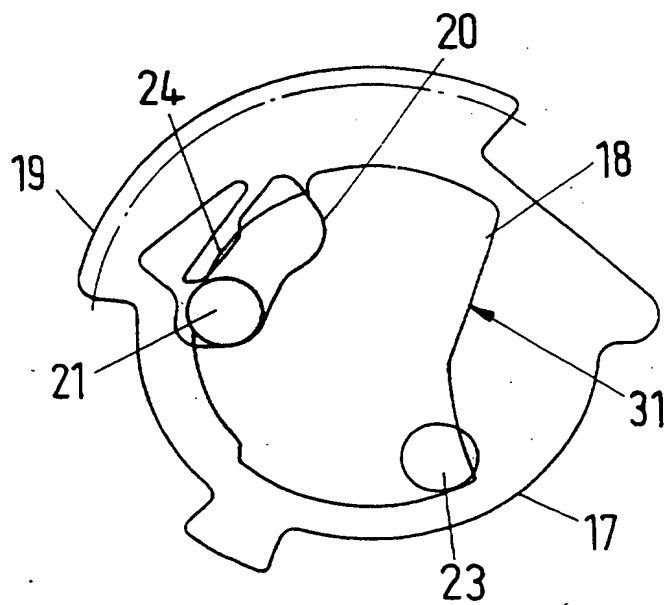


Fig. 10



"Motor vehicle door lock"

This invention relates to a motor vehicle door lock having a rotary latch, a pawl and a release element for the pawl (or for the rotary latch),

having an operating lever system which acts on the release element and which comprises an
5 interior operating lever and an exterior operating lever,

having a locking lever system, which comprises a locking central lever which is actively connected to an interior locking lever, and which comprises a central locking element and an exterior locking lever,

10

having an electric motor-operated, reversible central locking drive which moves the central locking element (and, via the latter, the locking central lever) into "unlocked" and "locked" operating positions, wherein

- 15 - the locking central lever is connected to the operating lever system via a coupling lever, and
- in the "locked" operating position of the coupling lever the interior operating lever and the exterior operating lever can be operated with an idle stroke.

20

A motor vehicle door lock of this type is known in which the locking central lever and the central

locking element are constructed as cooperating components, but in fact are separate components (see DE 195 33 199). In this known design, which is equipped with a theft protection function, the coupling lever comprises a theft protection element. The central locking drive comprises a power take-off element with a control pin, which can be moved under control into a "theft-protected" operating position in which the control pin locks the coupling lever in its "locked" operating position via the theft protection element. For this purpose, the theft protection element is disposed on a theft protection arm, and has a locking edge which engages behind the control pin in its "theft-protected" operating position. In addition, the theft protection element can be swivelled between a "normal operation" and an "emergency unlocking" operating position.

A basic object of the present invention is to create a motor vehicle door lock of the form of construction described at the outset in which a motor-operated theft protection system is implemented by the interior locking lever executing an idle stroke whilst the exterior locking lever is still effective, i.e. so that if the theft protection system is activated and becomes jammed, for example, or if there is a failure of the vehicle electronics, the motor vehicle door lock can still be unlocked by operating the exterior locking lever.

According to the present invention, there is provided a motor vehicle door lock having a rotary latch, a pawl and a release element for the pawl,

having an operating lever system which acts on the release element and which comprises an interior operating lever and an exterior operating lever, having a locking lever system, which comprises a locking central lever which is actively connected to an interior locking lever, and which comprises a central locking element and an exterior locking lever,

having an electric motor-operated, reversible central locking drive which moves the central locking element into "unlocked and "locked" operating positions, wherein

- the locking central lever is connected to the operating lever system via a coupling lever, and

- in the "locked" operating position of the coupling lever the interior operating lever and the exterior operating lever can be operated with an idle stroke,

10 with the locking central lever and the central locking element assembled to form a one-piece central locking lever,

with, in the "locked" direction of operation, the central locking lever and the coupling lever positively connected to each other and in the "unlocked" direction of operation non-positively

15 connected to each other via a pull-back spring,

with the central locking lever, the exterior locking lever and the coupling lever swivel-mounted on a common bearing axis,

20 with a power take-off element of the central locking drive, a theft protection power take-off element, and a theft protection disc rotatably mounted on an axis of rotation which is parallel to the bearing axis, wherein

- the theft protection power take-off element (17) comprises a toothed segment and

an arcuate coupling aperture (or a coupling pin),

- the theft protection disc has a coupling pin which engages in the coupling aperture of the theft protection power take-off element or conversely the theft protection power take-off element has a coupling pin which engages in a coupling aperture of the theft protection disc, and the theft protection disc has a theft protection pin which engages in a theft protection aperture of the coupling lever,
- the theft protection power take-off element and the theft protection disc are connected to each other by means of a spring element which presses the coupling pin against one end or the other end of the coupling aperture,
- an electric motor-operated, reversible theft protection drive acts on the toothed segment of the theft protection power take-off element, and
- after the theft protection power take-off element and the theft protection disc have been moved by means of the theft protection drive into the "theft protection on" operating position, the coupling lever is locked by the theft protection pin.

The consequence of these measures according to the invention is that the exterior operating lever can only be operated to release the rotary latch, whereby the latter is moved into the "open" operating position by a rotary latch spring, if firstly the theft protection system is not activated and secondly the central locking lever, and consequently the interior locking lever also, are situated in the "unlocked" operating position. In the "locked" operating position of the central locking-

lever, the exterior operating lever, and consequently the interior operating lever also, execute an idle stroke, both with and without the activation of the theft protection system. When the theft protection system is activated, the exterior operating lever and the interior operating lever execute an idle stroke even if the central locking lever is situated in the "unlocked" operating position, just as they do when the central locking lever is situated in the "locked" operating position. In both these situations, the central locking lever executes an idle stroke, without entraining the coupling lever, in order to form an active connection with the operating lever system. Thus, like the central locking lever, the interior locking lever also inevitably executes an idle stroke in these operating positions. It is only the exterior locking lever which is still effective, i.e. the motor vehicle door lock can still be unlocked by an authorised person by means of the exterior locking lever, even if the central locking lever is situated in the "unlocked" and "locked" positions and the theft protection system is activated. Emergency unlocking is possible in this manner, for example if there is a failure of the vehicle electronics or if the theft protection drive becomes jammed, by turning back the central locking lever, the coupling lever and the theft protection disc manually using the exterior locking lever.

Other measures which constitute the essence of the invention are listed below. Thus a bent-off driver catch of the central locking lever is preferably seated against a driver projection on the coupling lever with the formation of a positive connection in the "locked" direction of operation. In addition, the central locking lever advantageously comprises a bracket which performs the function of a locking prevention device. By this means, the motor vehicle door lock cannot be locked when a vehicle door is open, so that the user cannot unintentionally lock his key in the motor vehicle. This locking prevention device is generally only present on the driver's door, however. The invention further provides for the exterior locking lever to have an arcuate slot through which the driver catch on the central locking lever passes and which enables the central

locking lever to execute an idle stroke even if the theft protection system is activated. This arcuate slot always makes it possible for the central locking lever to execute an idle stroke in relation to the exterior locking lever, since the circular arc which the driver catch describes between the "unlocked" and "locked" positions and back is smaller than the arcuate slot in the exterior locking lever. The exterior locking lever is prevented from moving if a key which does not fit is inserted, since it is connected to the closing cylinder (or to a closing cylinder power take-off, for example an eccentric). Accordingly, the exterior locking lever describes a larger arc during emergency unlocking, wherein it first moves by the extent of idle travel and actual operation commences when the edge of the arcuate slot strikes against the driver catch of the central locking lever. According to the invention, the exterior locking lever has an actuating finger which cooperates with a radial cam on the theft protection disc, in order thus to be able to deactivate the theft protection system when the exterior locking lever is operated. The central locking drive, the central locking lever, the theft protection power take-off element, the theft protection disc, the exterior locking lever and the coupling lever are disposed one above another in layers, so that a flat, compact form of construction is achieved.

The invention is explained in greater detail below with reference to the drawings, which merely illustrate examples of embodiments, and where:

Figure 1 is a schematic general view of a motor vehicle door lock according to the invention in the "unlocked" operating position, in which the rotary latch and pawl are indicated;

Figure 2 illustrates a central locking drive for subject of Figure 1, as a view of the power

take-off element with its control pins which engage in a forked aperture of the central locking lever;

- 5 **Figure 3** shows the subject of **Figure 1** with the central locking lever situated in the "locked" operating position;
- Figure 4** shows the subject of **Figure 3** with the theft protection system activated via a theft protection drive;
- 10 **Figure 5** shows the subject of **Figure 4** with the exterior locking lever actuated;
- Figure 6** is a perspective illustration of the subject of **Figure 1**;
- Figure 7** shows an area from the subject of **Figure 6**, on an enlarged scale;
- 15 **Figure 8** shows the subject of **Figure 1** viewed in the direction of the lock housing with the rotary latch in the "closed" position;
- Figure 9** shows the theft protection disc and a modified form of construction of the theft protection power take-off element for the subject of **Figure 1**; and
- 20 **Figure 10** shows the subject of **Figure 9** in another operating position.

The Figures illustrate a motor vehicle door lock which comprises a rotary latch 1, a pawl 2 and

a release element 3 for the pawl 2 or for the rotary latch. In addition, an operating lever system is provided, which acts on the release element 3 and which comprises an interior operating lever 4 and an exterior operating lever 5. A locking lever system can also be seen. This locking lever system comprises a locking central lever which is actively connected to an interior locking lever 6, and comprises a central locking element and an exterior locking lever 7. The locking central lever and the central locking element are assembled to form a one-piece central locking lever 8, and therefore form a one-piece constructional unit.

An electric motor-operated, reversible central locking drive 9 moves the central locking lever 8 into the "unlocked" and "locked" operating positions. For this purpose, the central locking drive 9 comprises a power take-off element 10 with eccentric control pins 11 which engage in a forked aperture 12 of the central locking lever 8 and which, when correspondingly controlled via the central locking drive 9, execute control movements in which they rotate to the left and to the right on an arc of rotation, whereby the central locking lever 8 is moved into the "unlocked" and "locked" operating positions. When the control pins 11 are situated in the "locked" operating position they are free from the central locking lever 8 in order to permit manual operation of the central locking lever 8 between the "locked" and "unlocked" operating positions.

In the "locked" direction of operation, the central locking lever 8 and a coupling lever 13 which connects the operating lever system to the locking lever system are positively connected to each other, and in the "unlocked" direction of operation they are non-positively connected to each other via a pull-back spring 14. The central locking lever 8, the exterior locking lever 7 and the coupling lever 13 are swivel-mounted on a common bearing axis 15. The power take-off element 10 of the central locking drive 9, a theft protection power take-off element 17 and a theft-

protection disc 18 are rotatably mounted on an axis of rotation 16 which is parallel to said bearing axis 15. The theft protection power take-off element 17 comprises a toothed segment 19 and an arcuate coupling aperture 20 which runs in the direction of rotation of the theft protection disc 18, whilst the theft protection disc 18 has a coupling pin 21 which engages in the coupling aperture 20 of the theft protection power take-off element 17 and has a theft protection pin 23 which engages in a theft protection aperture 22 of the coupling lever 13. It is also possible, however, for the coupling aperture 20 to be situated in the theft protection disc 18 and for the coupling pin 21 to be situated on the theft protection power take-off element 17. The theft protection power take-off element 17 and the theft protection disc 18 are connected to each other by means of a spring element 24, e.g. a tilting spring, which permanently presses the coupling pin 21 in a clockwise direction against the relevant end of the coupling aperture 20. An electric motor-operated, reversible theft protection drive 25 acts on the toothed segment 19 of the theft protection power take-off element 17.

After the theft protection power take-off element 17 and the theft protection disc 18 have been moved or rotated by means of the theft protection drive 25 into the "theft protection on" operating position, the coupling lever 13 is locked by the theft protection pin 23.

A bent-off driver catch 26 of the central locking lever 8 is seated against a driver projection 27 on the coupling lever 13 with the formation of a positive connection in the "locked" direction of operation. The central locking lever 8 comprises a bracket 28 which prevents the locking mechanism from being operated when a vehicle door is open. The exterior locking lever 7 has an arcuate slot 29 which runs in the direction of swivelling of the central locking lever 8 and through which the driver catch 26 on the central locking lever 8 passes. In addition, the exterior locking

lever 7 has an actuating finger 30 which cooperates with a radial cam 31 on the theft protection disc 18 and which can release the latter.

The central locking drive 9, the central locking lever 8, the theft protection power take-off element 17, the theft protection disc 18, the exterior locking lever 7 and the coupling lever 13 are disposed or arranged in layers one above another.

Figure 1 illustrates the "unlocked" operating position. The release train is illustrated which is activated and interrupted by way of interior and exterior operation. As shown in Figure 3, the central locking lever 8 has swivelled downwards into the "locked" operating position and has entrained the coupling lever 13 via a positive connection. From this position, when the central locking lever 8 swivels, the coupling lever 13 is entrained by means of the interior locking lever 6 back into the "unlocked" operating position via the pull-back spring 14 between the central locking lever 8 and the coupling lever 13. In Figure 3, the theft protection system is shown activated via the theft protection drive 25; it is consequently activated by a second reversibly operated electric motor and by the toothed segment 19 on the theft protection power take-off element 17. The theft protection power take-off element 17 has also entrained the theft protection disc 18 in a clockwise direction via the adjusting spring or tilting spring 24. The theft protection pin 23 on the theft protection disc 18 prevents the coupling lever 13 from swivelling upwards and consequently prevents it from swivelling back, so that the central locking lever 8 executes an idle stroke. This is because the central locking lever 8 cannot henceforth be swivelled, with the deflection of the pull-back spring 14, without the entrainment of the coupling lever 13. In normal operation, the theft protection system is deactivated again via the theft protection drive 25, by means of a power take-off pinion 32 which meshes with the toothed segment 19 of the theft

protection power take-off element 17, in that the theft protection power take-off element 17 is rotated back (after it has previously been rotated forwards in order to activate the theft protection system). However, if the electric theft protection drive 25 fails to deactivate the theft protection system, the theft protection disc 18 can be turned back manually by means of the vehicle key, via an operating mechanism which acts on the exterior locking lever 7. In the course of this procedure, the theft protection disc 18 is separated from the theft protection power take-off element 17, which is locked or which is at least made difficult to operate by its toothed segment 19 and by the power take-off pinion 32 or the power take-off spindle thereof on the theft protection drive 25. This is illustrated in Figure 5.

In the embodiment illustrated in Figures 9 and 10, the theft protection power take-off element 17 and the theft protection disc 18 are not connected to each other by means of a tilting spring, but are connected by means of a resilient spring lip 24 which is integrally formed on the theft protection power take-off element 17 which comprises the arcuate coupling aperture 20 and which is produced as a plastics component. In this variant, the coupling pin 21 is pressed against one or the other end of the coupling aperture by the spring lip 24, the middle of which is arched towards the coupling aperture 20. Figure 9 illustrates the normal situation. Figure 10 shows the situation after emergency unlocking has been effected via the exterior locking lever 7. One advantage of this form of construction is that the tilting spring, which is otherwise customarily present as a separate component between the theft protection power take-off element 17 and the theft protection disc 18, is dispensed with. Another advantage is that the forces which have to be exerted are different. Since a greater force can be applied when emergency unlocking is effected via the exterior locking lever 7 and thus via the key, the projection of the spring lip 24 is situated in the vicinity of that end of the coupling aperture 20 against which the coupling pin 21 is pressed

in normal operation. The theft protection disc 18, and thus the coupling pin 21, remain in the "emergency unlocked" position, as does the theft protection power take-off element 17, until the theft protection drive is in operation again, after the main battery has been replaced for example. After emergency unlocking has been effected, the theft protection disc 18 is situated in the "theft protection off" operating position (is turned anticlockwise) and the theft protection power take-off element 17 is situated in the "theft protection on" operating position. To effect synchronisation, the theft protection power take-off element 17 is rotated clockwise by the electric motor. In the course of this procedure, the theft protection disc 18 is held against a stop, which is not illustrated, so that during this rotation the spring lip 24 is pushed back and its arched portion by-passes the coupling pin 21. The force required for synchronisation is thus less than the force required for emergency unlocking, since the coupling pin 21 is at a distance from the projection on the spring lip 24 and thus has a longer lever arm.

CLAIMS:

1. A motor vehicle door lock having a rotary latch, a pawl and a release element for the pawl,

5 having an operating lever system which acts on the release element and which comprises an interior operating lever and an exterior operating lever, having a locking lever system, which comprises a locking central lever which is actively connected to an interior locking lever, and which comprises a central locking element and an exterior locking lever,

10 having an electric motor-operated, reversible central locking drive which moves the central locking element into "unlocked and "locked" operating positions, wherein

- the locking central lever is connected to the operating lever system via a coupling lever, and

15

- in the "locked" operating position of the coupling lever the interior operating lever and the exterior operating lever can be operated with an idle stroke,

20

with the locking central lever and the central locking element assembled to form a one-piece central locking lever,

with, in the "locked" direction of operation, the central locking lever and the coupling lever positively connected to each other and in the "unlocked" direction of operation non-positively connected to each other via a pull-back spring,

with the central locking lever, the exterior locking lever and the coupling lever swivel-mounted on a common bearing axis,

with a power take-off element of the central locking drive, a theft protection power take-off element, and a theft protection disc rotatably mounted on an axis of rotation which is parallel to the bearing axis, wherein

- the theft protection power take-off element comprises a toothed segment and an arcuate coupling aperture (or a coupling pin),
- the theft protection disc has a coupling pin which engages in the coupling aperture of the theft protection power take-off element or conversely the theft protection power take-off element has a coupling pin which engages in a coupling aperture of the theft protection disc, and the theft protection disc has a theft protection pin which engages in a theft protection aperture of the coupling lever,
- the theft protection power take-off element and the theft protection disc are connected to each other by means of a spring element which presses the coupling pin against one end or the other end of the coupling aperture,
- an electric motor-operated, reversible theft protection drive acts on the toothed segment of the theft protection power take-off element, and
- after the theft protection power take-off element and the theft protection disc

have been moved by means of the theft protection drive into the "theft protection on" operating position, the coupling lever is locked by the theft protection pin.

2. A motor vehicle door lock according to claim 1, wherein a driver catch of the central locking lever is seated against a driver projection on the coupling lever with the formation of a positive connection in the "locked" direction of operation.
3. A motor vehicle door lock according to claims 1 or 2, wherein the central locking lever comprises a bracket for preventing the locking mechanism from operating when vehicle doors are open.
4. A motor vehicle door lock according to any one of claims 1 to 3, wherein the exterior locking lever has an arcuate slot through which the driver catch on the central locking lever passes.
5. A motor vehicle door lock according to any one of claims 1 to 4, wherein the exterior locking lever has an actuating finger which cooperates with a radial cam on the theft protection disc.
6. A motor vehicle door lock according to any one of claims 1 to 5, wherein the central locking drive, the central locking lever, the theft protection power take-off element, the theft protection disc, the exterior locking lever and the coupling lever are disposed one above another.
7. A motor vehicle door lock according to any one of claims 1 to 6, wherein the spring

element is constructed as a tilting spring.

8. A motor vehicle door lock according to any one of claims 1 to 6, wherein the spring
element is constructed as a spring lip on the theft protection power take-off element and forms
5 one flank of the coupling aperture, wherein an alternative space for the spring lip, which is arched
in the middle towards the coupling aperture, is provided on the side of the spring lip facing away
from the coupling aperture.

9. A motor vehicle door lock substantially as hereinbefore described with reference to
10 the accompanying drawings.



17

Application No: GB 9902356.6
Claims searched: 1-8

Examiner: Philip Silvie
Date of search: 21 May 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): E2A (AARN, AMXF)

Int Cl (Ed.6): E05B (47/00, 65/20)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2 304 796 A (KIEKERT)	1

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